

**REMARKS**

Claims 1 and 38 have been amended to recite the subject matter of claim 6. Claims 1-5, 19, 22, 23, and 38-40 have been amended to improve antecedent basis. Claims 1 and 5 have also been amended to improve the clarity thereof. Claim 6 has been amended to recite that the catalyst is a solid catalyst or a liquid catalyst. Support for this amendment is found in the as-filed specification at at least paragraph [0043].

The Office Action mailed May 26, 2006, has been received and reviewed. Claims 1-44 are currently pending in the application, of which claims 1-31 and 38-44 are under examination. Claims 32-37 are withdrawn from consideration as being drawn to a non-elected invention and have been canceled without prejudice to the filing of one or more divisional applications including same. Claims 1-31 and 38-44 stand rejected. Applicants have amended claims 1-6, 19, 22, 23, and 38-40, and respectfully request reconsideration of the application as amended herein.

**35 U.S.C. § 103(a) Obviousness Rejections**

Obviousness Rejection Based on U.S. Patent No. 5,326,923 to Cooper et al. in view of the American Chemical Society publication to Seapan et al.

Claims 1-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,326,923 to Cooper *et al.* ("Cooper") in view of the American Chemical Society publication to Seapan *et al.* ("Seapan"). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for an obviousness rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The obviousness rejection of claims 1-27 is improper because the cited references do not

teach or suggest all of the claim limitations and do not provide a motivation to combine to produce the claimed invention.

Cooper teaches a solvent extraction process for regenerating a solid acidic catalyst that is used to alkylate an isoparaffin with an olefin to produce an alkylate. Cooper at column 6, lines 7-12 and column 6, line 35-column 7, line 1. The alkylation reaction involves contacting the isoparaffin with the olefin in the presence of the solid acidic catalyst and a Lewis acid at a temperature ranging from -30°C to 50°C to produce the alkylate. *Id.* at column 9, lines 24-35. The isoparaffin has from four to ten carbons, such as isobutane. *Id.* at column 9, lines 53-57. The olefin has from three to five carbons. *Id.* at column 9, lines 57-59. A mixture of highly branched alkanes is produced by the alkylation reaction. *Id.* at column 9, lines 60-61. After being deactivated by residue produced by the alkylation reaction, the solid acidic catalyst is regenerated by contacting the solid acidic catalyst with a liquid solution including a solvent, such as SO<sub>2</sub>, oxygenates, such as C<sub>1</sub>-C<sub>4</sub> alcohols, ketones, and aldehydes, nitriles, or phenols. *Id.* at column 10, lines 29-38. The liquid solution removes a portion of the reaction residue produced by the alkylation reaction. *Id.* at column 10, lines 56-58. The regenerating process is performed at a temperature of between 0°C-50°C. *Id.* at column 11, lines 5-7.

Seapan teaches regenerating a catalyst using a supercritical fluid extraction technique. Seapan at p. 79. Tetrahydrofuran, pyridine, SO<sub>2</sub>, and CO<sub>2</sub>, were tested under supercritical conditions to determine their respective abilities to remove coke from the catalyst. *Id.* at p. 82. Of the tested solvents, pyridine, SO<sub>2</sub>, and CO<sub>2</sub> effectively removed coke from the catalyst. *Id.* at p. 83-88.

The cited references do not teach or suggest the limitation of “contacting the catalyst with a fluid reactivating agent that is at or above a critical point of the fluid reactivating agent and is of sufficient density to dissolve impurities, wherein the fluid reactivating agent is capable of transferring a hydride ion to the at least one fouling agent.” Cooper does not teach or suggest this limitation because its solid acidic catalyst is regenerated by contact with a liquid solution of SO<sub>2</sub>, oxygenates, such as C<sub>1</sub>-C<sub>4</sub> alcohols, ketones, and aldehydes, nitriles, or phenols. However, none of these compounds are capable of transferring a hydride ion. The Examiner states that Cooper teaches this limitation because Cooper teaches “periodically introducing hydrogen.” Office Action of May 26, 2006, p. 4. However, as known in the art, hydrogen is H<sub>2</sub> and is not a hydride ion. Seapan also does not teach or suggest this limitation because pyridine, SO<sub>2</sub>, and CO<sub>2</sub>, which

are taught to remove coke from the catalyst, are not capable of transferring a hydride ion.

Contrary to the Examiner's assertion, Cooper also does not teach or suggest the limitations of "removing the at least one fouling agent from the catalyst" and "recycling the fluid reactivating agent." Rather, the section of Cooper relied upon by the Examiner teaches that hydrocarbons and Lewis acids, which are present in the alkylation reaction, are recycled. Seapan also does not teach or suggest these limitations.

The cited references also do not provide a motivation to combine to produce the claimed invention. To provide a motivation or suggestion to combine, the prior art or the knowledge of a person of ordinary skill in the art must "suggest the desirability of the combination" or provide "an objective reason to combine the teachings of the references." M.P.E.P. § 2143.01. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *Id.* (emphasis in original).

The Examiner acknowledges that Cooper "fails to disclose reaction with at least some of the impurities" and relies on Seapan as teaching the limitation of "reacting the fluid reactivating agent with the at least one fouling agent." Office Action of May 26, 2006, p. 3. The Examiner states that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the reaction of Seapan in the regeneration process of Cooper because Cooper refers to Seapan's disclosure of supercritical SO<sub>2</sub> to remove impurities . . . and Cooper [sic] discloses his treatment with supercritical reactive and strong solvents to break down macromolecular structures." *Id.*

However, Cooper's reference to Seapan does not suggest the desirability of the combination or provide an objective reason to combine the teachings to produce the claimed invention. As described above, the regeneration processes of Cooper and Seapan are performed under different temperature and pressure conditions. The regeneration process of Cooper is performed at 0°C-50°C with a liquid solution while the regeneration process of Seapan is performed with pyridine, SO<sub>2</sub>, or CO<sub>2</sub> under supercritical conditions. Since it is known in the art that solvents have different properties at noncritical conditions versus critical conditions (see, for example, Seapan at p. 81-82), one of ordinary skill in the art would not be motivated to combine the solvent extraction regeneration process of Cooper with the supercritical fluid extraction regeneration process of Seapan to regenerate a catalyst.

Furthermore, even if Cooper and Seapan were combined, the claimed invention would not be produced because the catalyst would not be contacted with a fluid reactivating agent that is capable of transferring a hydride ion. As previously discussed, neither Cooper nor Seapan teaches or suggests contacting their respective catalysts with a fluid reactivating agent that is capable of transferring a hydride ion to the at least one fouling agent.

Since the cited references do not teach or suggest all of the limitations of claim 1 and do not provide a motivation to combine, the obviousness rejection of claim 1 is improper and should be withdrawn.

Claims 2-31 are allowable, *inter alia*, as depending from an allowable base claim.

Claim 4 is further allowable because the cited references do not teach or suggest providing a catalyst that is at least partially deactivated by hydrogen deficient fouling agents. While Cooper teaches isobutylene, the isobutylene is part of the feedstream and is not a residue present on the solid alkylation catalyst of Cooper.

Claim 5 is further allowable because the cited references do not teach or suggest contacting the catalyst with the fluid reactivating agent that is at or above a critical point of the fluid reactivating agent and that comprises a solvent that reacts with the at least one fouling agent to facilitate removal, in total or in part, of the at least one fouling agent from a surface of the catalyst.

Claim 7 is further allowable because the cited references do not teach or suggest contacting the catalyst with the fluid reactivating agent comprising an alkane having at least one tertiary carbon atom or a compound that can be isomerized in the presence of the catalyst to form at least one tertiary carbon atom. While Cooper teaches isobutane, the isobutane is a starting material of the alkylation reaction and is not used to regenerate the solid alkylation catalyst.

Claim 8 is further allowable because the cited references do not teach or suggest contacting the catalyst with the fluid reactivating agent comprising a compound selected from the group consisting of isobutane, isopentane, and mixtures thereof. Contrary to the Examiner's assertion, Cooper teaches using isobutane as a starting material in the alkylation reaction and not as a fluid reactivating agent.

Claim 9 is further allowable because the cited references do not teach or suggest contacting the catalyst with the fluid reactivating agent comprising a compound selected from the group consisting of n-butane, n-pentane, or mixtures.

Claim 10 is further allowable because the cited references do not teach or suggest contacting the catalyst with the fluid reactivating agent comprising an aromatic compound selected from the group consisting of toluene, benzene, ethylbenzene, or mixtures thereof. Instead, the sections of Cooper cited by the Examiner teach a benzene alkylation reaction and that the residue on the solid alkylation catalyst is an aromatic compound.

Claim 17 is further allowable because the cited references do not teach or suggest contacting the catalyst with isobutane at a temperature ranging from about 100°C to about 300°C.

Claim 18 is further allowable because the cited references do not teach or suggest contacting the catalyst with isobutane at a pressure in the range of from about 200 psig to about 5000 psig. Since Cooper does not teach contacting the catalyst with isobutane, Cooper necessarily does not teach or suggest contacting the catalyst with isobutane at the recited pressure range.

Claim 19 is further allowable because the cited references do not teach or suggest contacting the catalyst with a fluid reactivating agent that is at or above a critical point of the fluid reactivating agent and is of sufficient density to dissolve at least one of the fouling agents and products of a reaction of the fluid reactivating agent with the fouling agents.

Claim 20 is further allowable because the cited references do not teach or suggest stabilizing the at least one fouling agent.

Claim 21 is further allowable because the cited references do not teach or suggest transferring a hydride ion from a fluid reactivating agent to the at least one fouling agent.

Claim 22 is further allowable because the cited references do not teach or suggest releasing at least one fouling agent having a molecular weight approximately equal to or higher than the molecular weight of the at least one fouling agent.

Claim 23 is further allowable because the cited references do not teach or suggest desorbing the at least one fouling agent from the catalyst and dissolving the at least one fouling agent in a fluid reactivating agent.

Claim 26 is further allowable because the cited references do not teach or suggest removing the at least one fouling agent from the fluid reactivating agent in a supercritical phase, a liquid phase, or a gas phase.

Claim 27 is further allowable because the cited references do not teach or suggest precipitating the at least one fouling agent from the fluid reactivating agent.

Claim 29 is further allowable because the cited references do not teach or suggest using the at least one fouling agent with a recycling catalyst.

Claims 30 and 31 are further allowable because the cited references do not teach or suggest reusing the fluid reactivating agent as a portion of a feed mix or as a reactivating agent.

Independent claim 38 recites similar limitations to claim 1 and, therefore, is allowable for substantially the same reasons as discussed above for claim 1. Specifically, the cited references do not teach or suggest the limitations of “directing a fluid reactivating agent towards at least one catalyst that is at least partially deactivated by at least one fouling agent, the at least one catalyst located in at least one reactor, wherein the fluid reactivating agent is capable of transferring a hydride ion to the at least one fouling agent,” “removing the at least one fouling agent from the fluid reactivating agent,” and “recycling the fluid reactivating agent.” The cited references also do not provide a motivation to combine to produce the invention of claim 38 for substantially the same reasons as discussed above for claim 1.

Claims 39-44 are allowable, *inter alia*, as depending from an allowable base claim.

### **Double Patenting Rejections**

Claims 1-31 and 38-44 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 6,579,821. Claims 1-31 and 38-44 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-69 of U.S. Patent No. 6,887,813.

In order to avoid further expenses and time delay, Applicants elect to expedite the prosecution of the present application by filing terminal disclaimers to obviate the double patenting rejections in compliance with 37 CFR §§ 1.321 (b) and (c). Applicants’ filing of the terminal disclaimers should not be construed as acquiescence to the Examiner’s double patenting or obviousness-type double patenting rejections. Attached are the terminal disclaimers and accompanying fees.

**ENTRY OF AMENDMENTS**

The amendments to claims 1-6, 19, 22, 23, and 38-40 should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add new matter to the application.

**CONCLUSION**

Claims 1-31 and 38-44 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain that might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,

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